

APPEAL BRIEF

Applicant: KIA SILVERBROOK

Application No.: 10/753,499

Filing Date: JANUARY 9, 2004

Title of the Invention: A 3-D OBJECT CREATION
SYSTEM INCORPORATING
SEMICONDUCTOR MEMORY

Examiner: RICHARD Z. ZHU

Class 358

Art Unit: 2625

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REAL PARTY IN INTEREST

The real party in interest is SILVERBROOK RESEARCH PTY LTD, the assignee of record.

RELATED APPEALS AND INTERFERENCES

None

STATUS OF CLAIMS

Claim	Status
1	Rejected and Appealed
2	Rejected and Appealed
3	Rejected and Appealed
4	Rejected and Appealed
5	Rejected and Appealed
6	Rejected and Appealed
7	Rejected and Appealed
8	Rejected and Appealed
9	Cancelled
10	Cancelled
11	Rejected and Appealed
12	Rejected and Appealed
13	Cancelled
14	Cancelled
15	Cancelled
16	Cancelled
17	Rejected and Appealed
18	Rejected and Appealed
19	Rejected and Appealed
20	Rejected and Appealed
21	Rejected and Appealed
22	Rejected and Appealed

STATUS OF AMENDMENTS

The claims as pending are as received by the USPTO on November 26, 2008.

SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 is directed to a three dimensional object creation system (200 - Fig. 2; pp. 18, ln. 6 - 10) for printing a three dimensional object comprised of layers (110, 114, 118, 119 - Fig. 2) stacked vertically with respect to each other. The system (200) comprises a series of printheads (206 - Fig. 2; pp 18, ln. 24 - 25) for printing the layers (110, 114, 118, 119). The series of printheads (206) simultaneously print at least two layers of different vertical positions within the stack.

The claimed three dimensional object creation system (200) further comprises a semiconductor memory (pp. 32, ln. 15 - pp 34, ln. 5) for storing data defining at least one layer. The system (200) is operable to reconfigure a printhead initially configured to print a layer at a first vertical position to print a layer at a second vertical position.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

1. Whether claims 1, 2, 7, 11 - 12, and 17 are unpatentable under 35 U.S.C. 103 over Penn et al. (US 6,169,605) in view of Jang et al. (US 2002/0062909).

ARGUMENTS

(1) REJECTION UNDER 35 U.S.C. 103(a) OVER PENN ET AL. (US 6,169,605) IN VIEW OF JANG ET AL. (US 2002/0062909)

Claims 1, 2, 7, 11 - 12, and 17

Independent claim 1 is rejected as unpatentable under 35 U.S.C 103(a) over Penn et al. in view of Jang et al.

In rejecting independent claim 1, the Examiner contends that Penn et al. teach printing at least two layers of different materials within a stack simultaneously. However, the Examiner acknowledges that Penn et al. fail to teach the simultaneous printing of two layers of different vertical positions within the stack. To account for this deficiency of Penn et al., the Examiner cites Jang et al.

A brief summary of Jang et al. and Penn et al. follows.

Jang et al. describe a method for forming a 3-D structure. The steps of this method are most concisely described from paragraphs [0111] to [0118], and involve laying down a first porous layer, filling portions of the first porous layer with a first pore-filling material, then laying down a second subsequent porous layer on top of the first porous layer, and further filling portions of the second porous layer with a second (different) pore-filling material. These steps are repeated to stack up and successively build layers along a Z-direction.

To deposit the pore-filling materials in successive layers, Jang et al. moves a dispensing device in the Z-direction. That is, after the first porous layer has been sufficiently/adequately filled with the pore-filling material, the dispensing device is displaced in the Z-direction (e.g. upwards) so that it can then inject pore-filling material into a second porous layer to be laid down on top of the first porous layer.

Applicant particularly notes that Jang et al. forms vertical layers one at a time. This is repeatedly mentioned in the description of Jang et al., where it is described that the 3D structure is formed “layer-by-layer”.

Further, it is noted that the method of Jang et al. lays down a porous layer, similar to a honeycomb or other fibrous material, into which the pore-filling material is deposited. These porous layers are laid down one on top of each other. As such, it is clear that one vertical layer of the stack must be completely formed before a subsequent layer can be formed thereupon.

Penn et al. describes a device for manufacturing a 3-D object. The object created by the device includes conductive material 25, and non-conductive material 35. Penn et al. explicitly defines one layer of the 3-D object as a layer at a particular vertical position in the stack forming the 3-D object, which layer comprises a combination of both conductive material 25 and non-conductive material. However, the Examiner is interpreting Penn et al. such that a “layer” is construed as an area of one homogenous material. That is, an area

of conductive material is construed by the Examiner as “one layer” and an area of non-conductive material is construed by the Examiner as a “second layer”, even if both such areas are at the same vertical position in the stack.

The device of Penn et al. comprises one printhead 20 for dispensing the conductive material 25, and a second printhead 670 for dispensing the non-conductive material 35. The two printheads 20, 670 can operate simultaneously, thereby simultaneously depositing conductive and non-conductive materials to form one vertical layer of the stack. Specifically, it is described at col. 16, lines 46 - 51, that:

“In operation, the printed circuit board is constructed by printhead 20 dispensing conductive object material 25 at those locations at which printed conductor lines are to be located in each layer. In the same single pass, printhead 670 dispenses insulative support material 35 as required to fill the remainder of the layer”.

The Examiner’s rationale and logic in combining Penn et al. with Jang et al. is most concisely set forth in the Advisory Action dated November 19, 2009, and which rationale and logic is summarized as follows:

- i. Penn et al. teach a series of printheads for printing “layers”. The series of printheads simultaneously print at least two “layers” of the same vertical position within a stack. The first “layer” is construed as the layer of first (conductive) material 25, and the second “layer” is construed as the layer of second (non-conductive) material 35, both having the same vertical position in the stack.
- ii. Jang et al. teach a 3-D object formed by printing (non-simultaneously) at least two layers of different vertical positions within a stack, one after the other. A first layer is formed from a first pore-filling material, and a subsequent layer formed on top of the first layer is formed from a second (different) pore-filling material. Jang et al. further teach printing a first layer of a first material, and thereafter reconfiguring the printhead to print a second layer of second material in vertical succession.
- iii. Hence, the Examiner contends that if Penn et al. can use at least two printheads to simultaneously print two different materials within the same vertical positions, and since Jang et al. describes an object where one vertical layer is of a first material and a subsequent vertical layer is of a second (different) material, it is then not unpredictable for one of ordinary skill in the art to arrive at the configuration where the two different materials are simultaneously printed at two different vertical positions because, allegedly, Jang et al. explicitly suggest that it is possible.

Applicant respectfully disagrees with the Examiner’s above rationale and logic.

Firstly, the fact that Jang et al. describe a 3-D object where one vertical layer is made of a first material, and a subsequent vertical layer is made of a second (different) material, does not teach or suggest or motivate a modification of Penn et al. to arrive at a device that can simultaneously print different vertical layers in a stack. The 3-D object of Jang et al. is merely the object formed by the device/method of Jang et al. This object is a result, and does not teach, suggest, or motivate any particular modification of the device of Penn et al. This object of Jang et al. can be satisfactorily formed by the device of Penn et al. without any modifications at all to the device of Penn et al.

Importantly, the fact that the 3-D object of Jang et al. is made up of a first vertical layer of a first material, and a second vertical layer of a second (different) material does not indicate to one of ordinary skill in the art how the device of Penn et al. should be modified such that the different materials in different vertical layers can be simultaneously printed. The Examiner states at page 4 of the Advisory Action that “...it is not unpredictable for one of ordinary skill in the art to arrive at the configuration where the two materials are simultaneously printed at two distinct vertical positions...”, however Applicant questions **what** this configuration would be, and **where** this configuration is taught, since neither Jang et al. nor Penn et al. suggest such a configuration.

It is untenable to suggest that one of ordinary skill in the art, if presented only with a 3-D object made up of a first vertical layer of a first material and a second vertical layer of a second (different) material, and a device that can print different materials simultaneously but only in the same vertical layer, would firstly desire to have a device that could print two or more different vertical layers simultaneously, and secondly be able to obviously arrive from the device of Penn et al. a new device that could print two or more different vertical layers simultaneously.

Rather, a person of ordinary skill in the art, if presented with the above information, would simply realize that the existing device of Penn et al. can already form the given 3-D object by forming each vertical layer one at a time. Accordingly, the person of ordinary skill in the art would not see any need to further modify the device of Penn et al.

Secondly, Jang et al. teach only that a printhead is displaced in the Z-direction so as to print a subsequent vertical layer on top of a vertical layer just printed. Jang et al. do not suggest that it is possible to simultaneously print at two different vertical positions. In fact, the opposite is true. The description of Jang et al. teaches that the printhead is displaced in the Z-direction only after the current vertical layer is complete.

In this regard, Applicant takes this opportunity to address the Examiner’s statement as provided on page 5 of the Advisory Action, which states:

“Therefore, in making the combination, the examiner found a base device in Penn that already simultaneously prints two different materials and it is ready to be improved by a known technique of printing the two different materials in respective vertical stacks suggested by Jang...” (emphasis added)

The “known technique” mentioned to by the Examiner above refers to the method of Jang et al. As already discussed, Jang et al. describes a method where vertical layers are printed layer-by-layer, one at a time, and one on top of each other. Jang et al. does not teach or suggest simultaneously printing at least two vertical layers. Therefore, improving the base device of Penn et al. by this “known technique” still would not arrive at the claimed invention.

Thirdly, both Jang et al. and Penn et al. explicitly teach a process of building a 3-D object where vertical layers are successively formed one on top of the other.

In Penn et al. (see for example col. 16, lines 18 - 61), one vertical layer is formed in a single pass by printheads 20 and 670. Then, a knife 660 that trails the printheads is used to

planarize the vertical layer just formed. Then, a subsequent vertical layer (layer-wise fashion) is formed on top of the vertical layer just formed.

In Jang et al., as summarized above, a 3-D object is formed by laying down a first porous material, dispensing a first pore-filling material into the first porous material, then laying down a second porous material on top of the first porous material, and further dispensing a second pore-filling material into the second porous layer.

Therefore, it is clear that there is no teaching or suggestion from either of Jang et al. and Penn et al. to print two vertical layers in the stack simultaneously. The fact that Penn et al. prints a conductive material and a non-conductive material in the same vertical layer simultaneously, does not mean that if it happened that the conductive and non-conductive materials were to be disposed in different vertical layers that Penn et al. suggest that such conductive and non-conductive materials at different vertical layers should also be simultaneously printed.

In view that neither Penn et al. nor Jang et al. disclose a method or device for printing at least two layers of different vertical positions within a stack simultaneously, Applicant questions where motivation to combine Penn et al. and Jang et al. to arrive at a method/device that can do so, originates from. Applicant respectfully believes that such motivation has originated from use of improper hindsight in view of Applicant's own disclosure.

Lastly, reference is made to the Examiner assertion at page 6, paragraph 2, of the advisory action, which states:

"Referring to the broad scope of the claim, the modification is such that Penn would simultaneously print two layers of materials, at two different vertical positions within a first pass, for example $y = 1$ and 2 respectively. Thereafter, it is dynamically reconfigured to simultaneously print the next two layers of materials at $y=3$ and 4 respectively"

Applicant questions where the teaching to modify the device of Penn et al. so as to simultaneously print at vertical positions $y = 1$ and 2 , and then simultaneously print at vertical positions $y = 3$ and 4 , originates from. Neither Penn et al. nor Jang et al. teach or suggest simultaneously printing at vertical positions $y = 1$ and 2 , and then $y = 3$ and 4 .

Applicant questions why Penn et al. would not instead simply use printhead 20 to completely print a first layer of first material at vertical position $y = 1$, then upon completely printing the first layer, moving printhead 670 to vertical position $y = 2$ to print a second layer of second material, then upon completely printing the second layer, moving printhead 20 to vertical position $y = 3$ to print a third layer of first material, and so on. Such an operation would be more in line with the combined teachings of Penn et al. and Jang et al., which both teach a successive layer-by-layer formation of the 3-D object. Applicant notes that there is no reason why, if one layer of the 3-D object is a homogenous layer of one material only, one of the printheads of Penn et al. cannot remain inactive.

For the above reasons, Applicant respectfully submits that the pending claims are novel and inventive over the combination of Penn et al. and Jang et al. Applicant respectfully seeks the Appeal Board's consideration of the above arguments.

CLAIMS APPENDIX

1. A three dimensional object creation system for printing a three dimensional object comprised of layers stacked vertically with respect to each other, the system comprising:
 - a series of printheads for printing the layers, the series of printheads simultaneously printing at least two layers of different vertical positions within the stack; and
 - a semiconductor memory for storing data defining at least one layer, wherein the system is operable to reconfigure a printhead initially configured to print a layer at a first vertical position to print a layer at a second vertical position.
2. The system of claim 1 wherein data defining all of the layers is stored in the semiconductor memory.
3. The system of claim 1 wherein each printhead includes at least some of the semiconductor memory.
4. The system of claim 1 wherein the semiconductor memory of each printhead stores data relating to at least the part of the layer printed by the printhead.
5. The system of claim 1 wherein the semiconductor memory of each printhead stores data relating to at least part of at least another layer.
6. The system of claim 1 wherein the semiconductor memory of each printhead stores data relating to at least part of the previous layer compared to the layer currently being printed by the respective printhead.

7. The system of claim 1 including data links between printheads.

8. The system of claim 1 including about 10 Gbytes of semiconductor memory.

9 - 10. (Cancelled)

11. The system as claimed in claim 1 wherein the printheads print two or more different materials in one layer.

12. The system as claimed in claim 11 wherein the printheads are configured such that at least one of the layers may be printed with a first set of materials and at least another one of the layers may be printed with a second set of materials, and the first and second sets are not the same.

13 - 16. (Cancelled)

17. The system as claimed in claim 11 including a least two printheads, a first one of the printheads printing a first material and a second one of the printheads printing a second material, the first material being cured by a first method and the second material being cured by a second method and wherein the first and second methods are different.

18. The system as claimed in claim 1 including at least one printhead for printing material to create a printed product, and an object incorporation device that incorporates inorganic semiconductors into the product being printed whilst the at least one printhead prints the

product.

19. The system as claimed in claim 1 including at least one object incorporation device that incorporates non-printed objects into partially completed product, the non-printed objects not being printed by the system.

20. The system as claimed in claim 1 including an object incorporation device that inserts at least one non-printed object into at least one cavity created during the printing process, the object incorporation device incorporating the at least one non-printed object into the at least one cavity during the printing of the respective printed object.

21. The system as claimed in claim 1 including at least one printhead that prints electrical connections to at least one object incorporated in the products.

22. The system according to claim 1, wherein upon failure of printhead whilst printing its respective layer, each subsequent printhead is dynamically reconfigured to complete the printing of at least part of the layer preceding its respective layer.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None